What is Claimed is:

[c1] A method for modeling the inputs and outputs integrated circuits, comprising the steps of:

representing in the model the output characteristics of driver circuits by two types of elements, switching and non-switching;

tabulating the output characteristics for each of the elements by applying a DC voltage source on the output of the driver and measuring the current through each element;

representing in the model switching elements as a voltage-time controlled resistors by obtaining the product of DC impedance as a function of voltage and a scalar that is a function of time; and

embedding in the model equations that are functions of input edge arrival times and cycle time for each scalar type.

[c2] The method of claim 1 also comprising the step of : accounting for variations in temperature and supply voltages, device DC characteristic can be obtained from the dc_base according to the equation: dc_impedance = (1+D0)*dc_base, where DO is a function of supply voltage and temperature

[c3] The method of claim 1 where the step of representing as a voltage time controlled resistor also comprises the step of: normalizing the time controlled impedance to the dc impedance to produce a time-varying scalar independent of the load used during characterization.

[c4] The method of claim 1 where such representation of the voltage-time controlled resistor is obtained starting with a midpoint of the input transition.

[c5] The method of claim 1 also comprising the step of saving the scalars in a tabular format.

[c6] The method of claim 1 also comprising the step of making wave-forms for the switching elements periodic in definitions as functions of periodic rising and falling input edge arrival times.

[c7] The method of claim 1 also comprising the step of applying indexing equations

to what? or where?

to account for variations in environmental conditions.

[c8] The method of claim 7 wherein the environmental conditions are slew rate, temperature or supply voltage.

[c9] The method of claim 1 where the switching elements reflect composite transient impedance behavior of a pull-up or pull-down network that are comprised of a plurality of FETs and parasitics.

[c10] The method of claim 1 where the non-switching elements are an ESD device and a power clamp.

[c11] The method of claim 1 where the method also comprising the steps of obtaining behavioral characteristics for a pre-drive current stage and a decoupling stage and applying them to the model.

[c12] A method for modeling the inputs and outputs integrated circuits, comprising the steps of:

representing in the model the output characteristics of driver circuits by two types of elements, switching and non-switching;

tabulating the output characteristics for each of the elements by applying a DC voltage source on the output of the driver and measuring the current through each element;

representing in the model switching elements as a voltage-time controlled resistors by obtaining the product of DC conductance as a function of voltage and a scalar that is a function of time; and

embedding in the model equations that are functions of input edge arrival times and cycle time for each scalar type.

[c13] The method of claim 12 also comprising the step of :

accounting for variations in temperature and supply voltages, device characteristic can be obtained from the dc_base according to the equation: dc_conductance = (1+D0)*dc_base, where DO is a function of supply voltage and temperature

[c14] The method of claim 12 where the step of representing as a voltage time

controlled resistor also comprises the step of: normalizing the time controlled conductance to the dc conductance to produce a time-varying scalar independent of the load used during characterization.

[c15] The method of claim12 where such representation of the voltage-time controlled resistor is obtained starting with a midpoint of the input transition.

[c16] The method of claim 12 also comprising the step of saving the scalars in a tabular format.

[c17] The method of claim 12 also comprising the step of making wave-forms for the switching elements periodic in definitions as functions of periodic rising and falling input edge arrival times.

[c18] The method of claim 12 also comprising the step of applying indexing equations to account for variations in environmental conditions.

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[c19] The method of claim 18 wherein the environmental conditions are slew rate, temperature or supply voltage.

[c20] The method of claim 12 where the switching elements reflect composite transient conductance behavior of a pull-up or pull-down network that are comprised of a plurality of FETs and parasitics

[c21] The method of claim 12 where the non-switching elements are an ESD device and a power clamp.

[c22] The method of claim 12 where the method also comprising the steps of obtaining behavioral characteristics for a pre-drive current stage and a decoupling stage and applying them to the model.

[c23]

A circuit which is used to model integrated circuits which comprises:

switching elements connected serially as voltage-time controlled resistors, one of the conductive elements acts to pull voltage up, the other conductive elements acting ~~acts~~ to pulls the voltage down ; and non-switching elements connected serially as resistors, one representing power structures and the other representing ground clamping structures;

each of the switching elements tied to input stage and both the switching and non-switching elements tied to an output

[c24] The circuit of claim 23 which also comprises a pre-drive stage coupled to the switching elements and a decoupling stage tied to the switching and non-switching elements and the pre-drive stage.

[c25] The circuit of claim 24 where a fixed value element is used to represent the pre-drive or decoupling stage.

[c26] The circuit of claim 24 where a non-switching element that is a function of parameters that not vary in time is used to represent the pre-drive or decoupling stage.

[c27] The circuit of claim 24 where a switching element which is a function of both time and non-time varying parameters is used to represent the pre-drive or decoupling stage.

[c28] A method for modeling the inputs and outputs integrated circuits, comprising the steps of:

representing in the model the output characteristics of driver circuits by two types of elements, switching and non-switching;

tabulating the output characteristics for each of the elements by applying a DC voltage source on the output of the driver and measuring the current through each element;

representing in the model switching elements as a voltage-time controlled resistors by obtaining the product of DC conductance or impedance as a function of voltage and a scalar that is a function of time;

accounting for variations in input slew rate, temperature, and supply voltages where device turn-on characteristic can be obtained from device_turn_on _base according to the equation:

device_turn_on = device_turn_on_base + (K0 + K1*max (device_turn_on_base -K2, 0)) , where K0, K1, and K2 are functions of supply voltage, input slew rate, and temperature;

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accounting for variations in temperature and supply voltages, device DC characteristic can be obtained from the dc_base according to the equation: dc_impedance (conductance) = (1+D0)*dc_base, where DO is a function of supply voltage and temperature; and

embedding in the model equations that are functions of input edge arrival times and cycle time for each scalar type.

[c29] A method for modeling the inputs and outputs integrated circuits, comprising the steps of:

representing in the model the output characteristics of driver circuits by two types of elements, switching and non-switching;

tabulating the output characteristics for each of the elements by applying a DC voltage source on the output of the driver and measuring the current through each element;

representing in the model switching elements as a voltage-time controlled resistors by obtaining the product of DC conductance or impedance as a function of voltage and a scalar that is a function of time;

accounting for variations in input slew rate, temperature, and supply voltages, device turn-on characteristic can be obtained from device_turn_on_base according to the equation:

device_turn_on = device_turn_on_base + (K0 + K1*max (device_turn_on_base -K2, 0)) , where K0, K1, and K2 are functions of supply voltage, input slew rate, and temperature;

accounting for variations in temperature and supply voltages, device DC characteristic can be obtained from the dc_base according to the equation: dc_impedance(conductance) = (1+D0)*dc_base, where DO is a function of supply voltage and temperature; and

embedding in the model equations that are functions of input edge arrival times and cycle time for each scalar type.

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